Aura OMI observations of global SO_2 and NO_2 pollution from 2005 to 2013

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Aura STM College Park, MD

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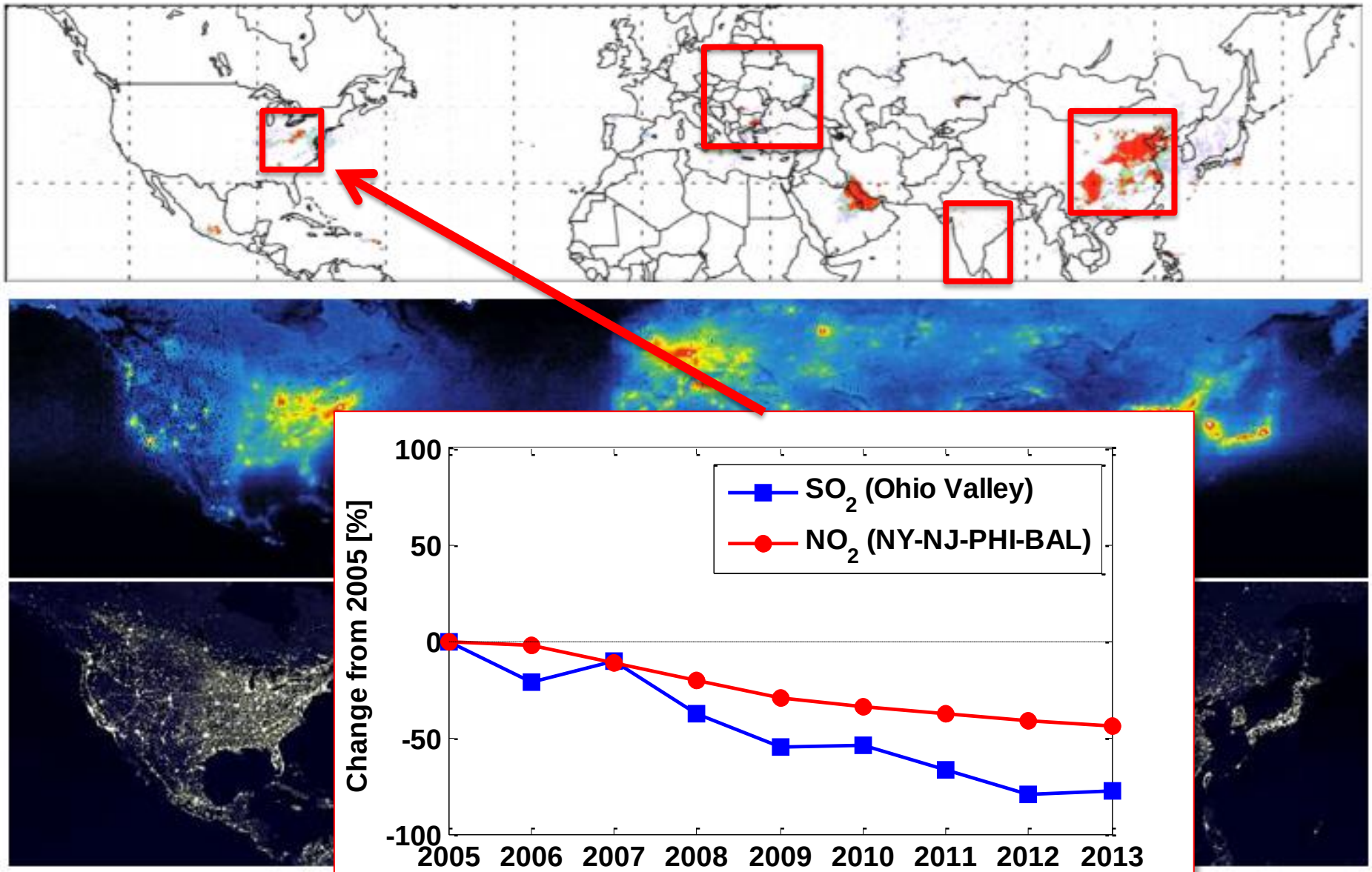
Key improvements in OMI NO_2 and SO_2

- ***Significant improvements in retrieval quality –***
  - Improved spectral fitting of OMI NO_2 removes 20%- 40% of the stratospheric biases with other satellite measurements. **New NO_2 version planned for release next year**
  - New PCA SO_2 algorithm uses full spectral content from OMI, reduces noise by half and removes biases (artifacts)
  - **New Version 2 OMI SO_2 dataset will be released this fall**
- ***Maximal data continuity between instruments –***
  - Both OMI NO_2 and SO_2 algorithms can benefit new missions: SNPP/ OMPS, TROPOMI, GEMS and TEMPO
  - no need to develop instrument-specific radiance data correction schemes
- **Maximal sensitivity -**
  - PCA SO_2 detection limit for point sources is half the current PBL algorithm
- ***Flexibility –***
  - PCA SO_2 fitting window can be easily adjusted to optimize sensitivity under different conditions: from small anthropogenic signals to largest volcanic plumes.
  - NO_2 fitting window can be expanded to UV wavelengths (OMPS)

Regional trends in OMI new SO_2 and NO_2 : 2005-2013



OMI SO_2 and NO_2 time series

- SZA < 70^o
- Cross-track CCD rows 6-23 (excluding row anomaly for all years) ;
- Snow-free observations (according to the IMS data* product);
- SCD-O_3<1500 DU, VCD_SO_2<15 DU
- Additional volcanic filtering: all days removed which, over that region and considering all years, had a daily 99.9^{th} percentile value greater than X,
  - where X=5 DU for Eastern North America,
    8 DU for Eastern Europe and India,
    10 DU for China –

  these thresholds are obtained using the 99.9 percentile daily regional time series.

  For consistency removed the same volcanic days in NO_2 product

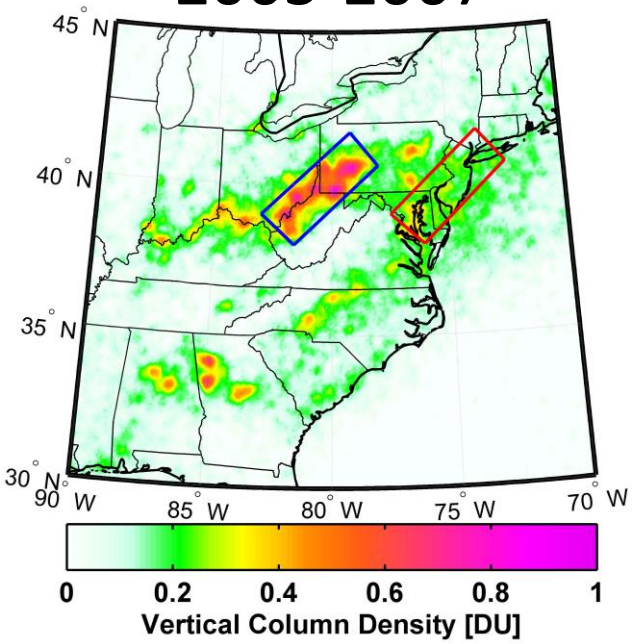
* Interactive multi-sensor snow and ice product, http://www.natice.noaa.gov/ims/

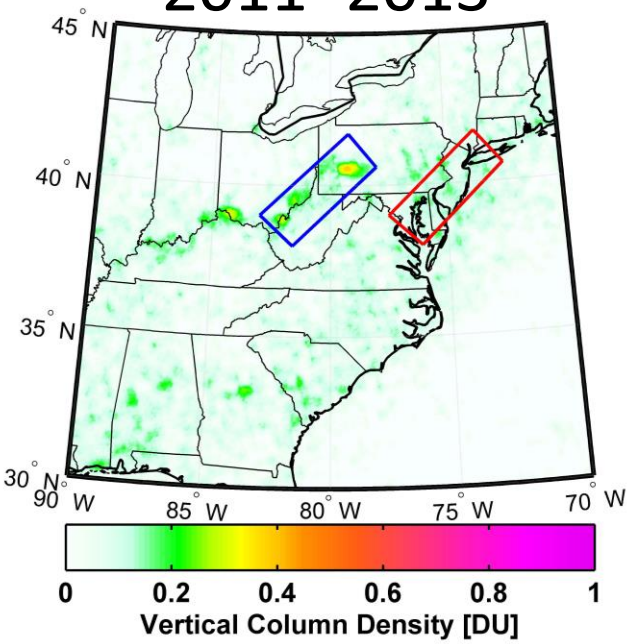
Eastern US

2005-2007

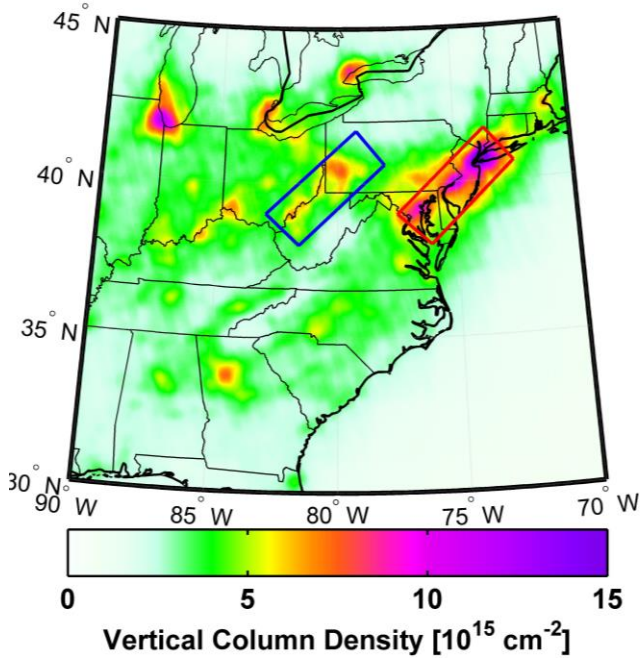
2011- 2013

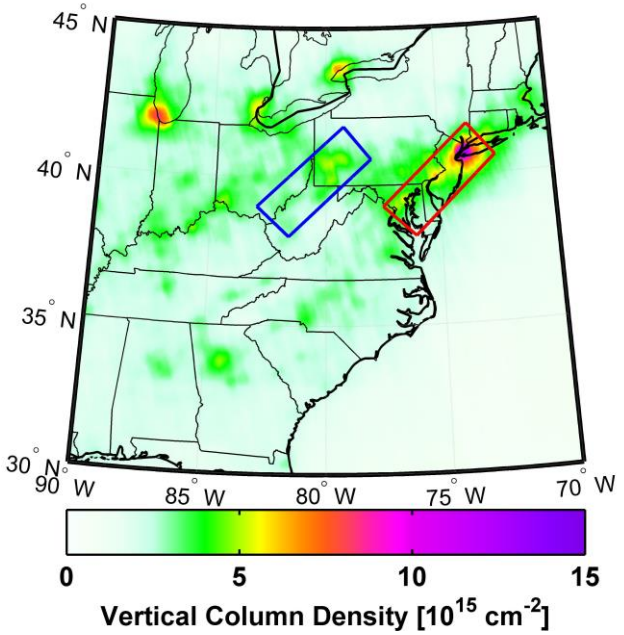
SO_2





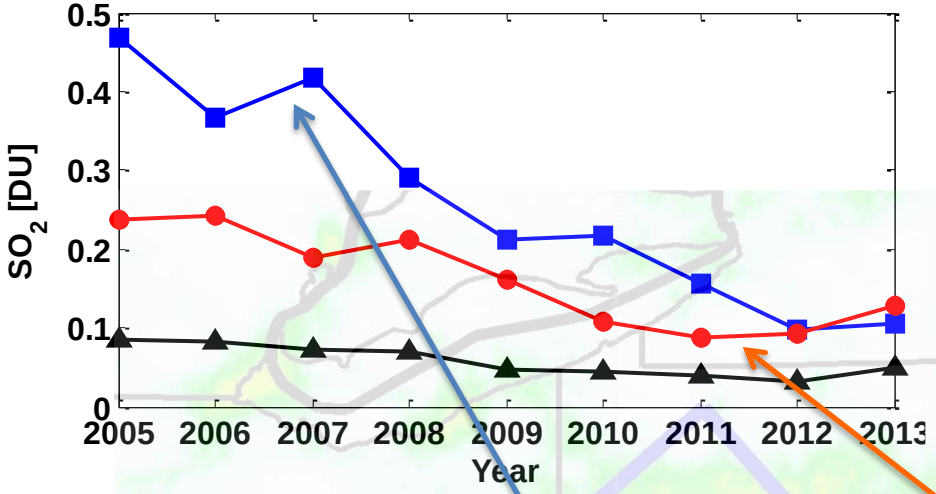
NO_2

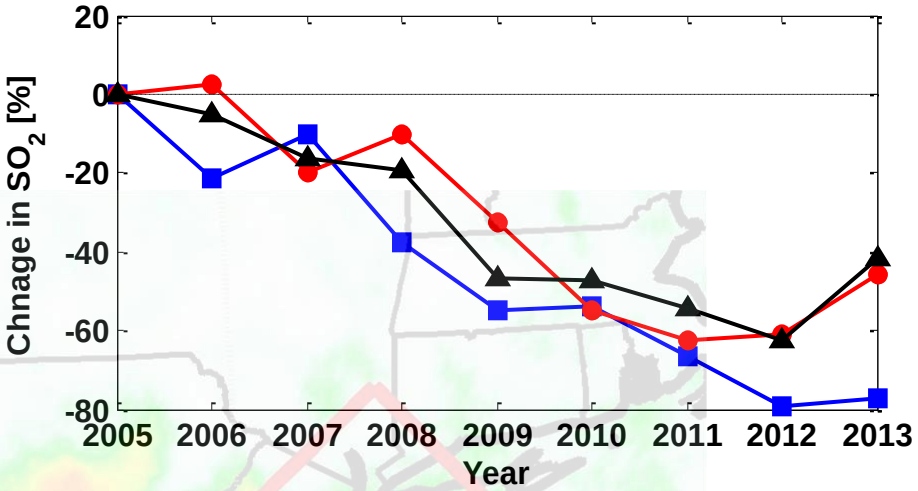




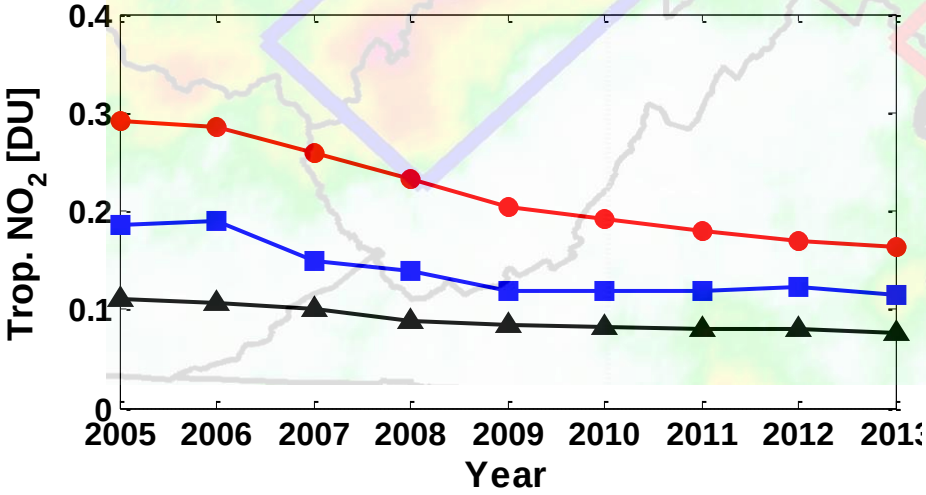
Eastern US

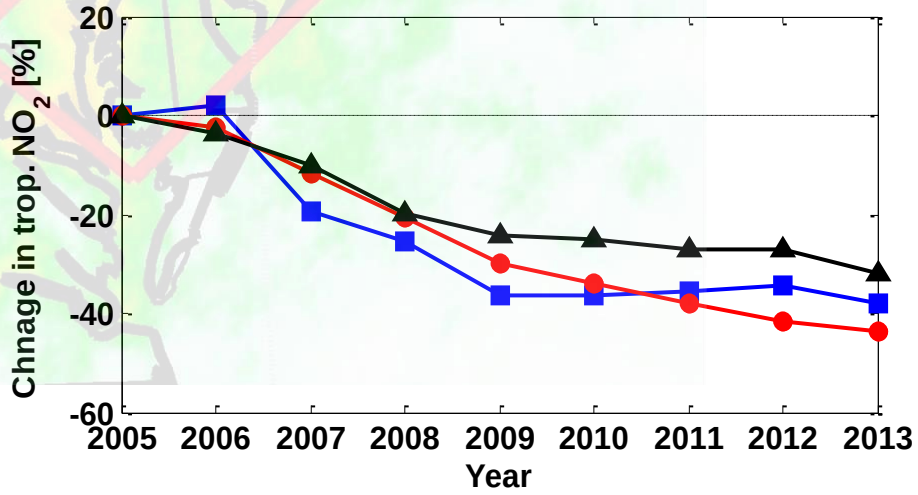
SO_2





NO_2



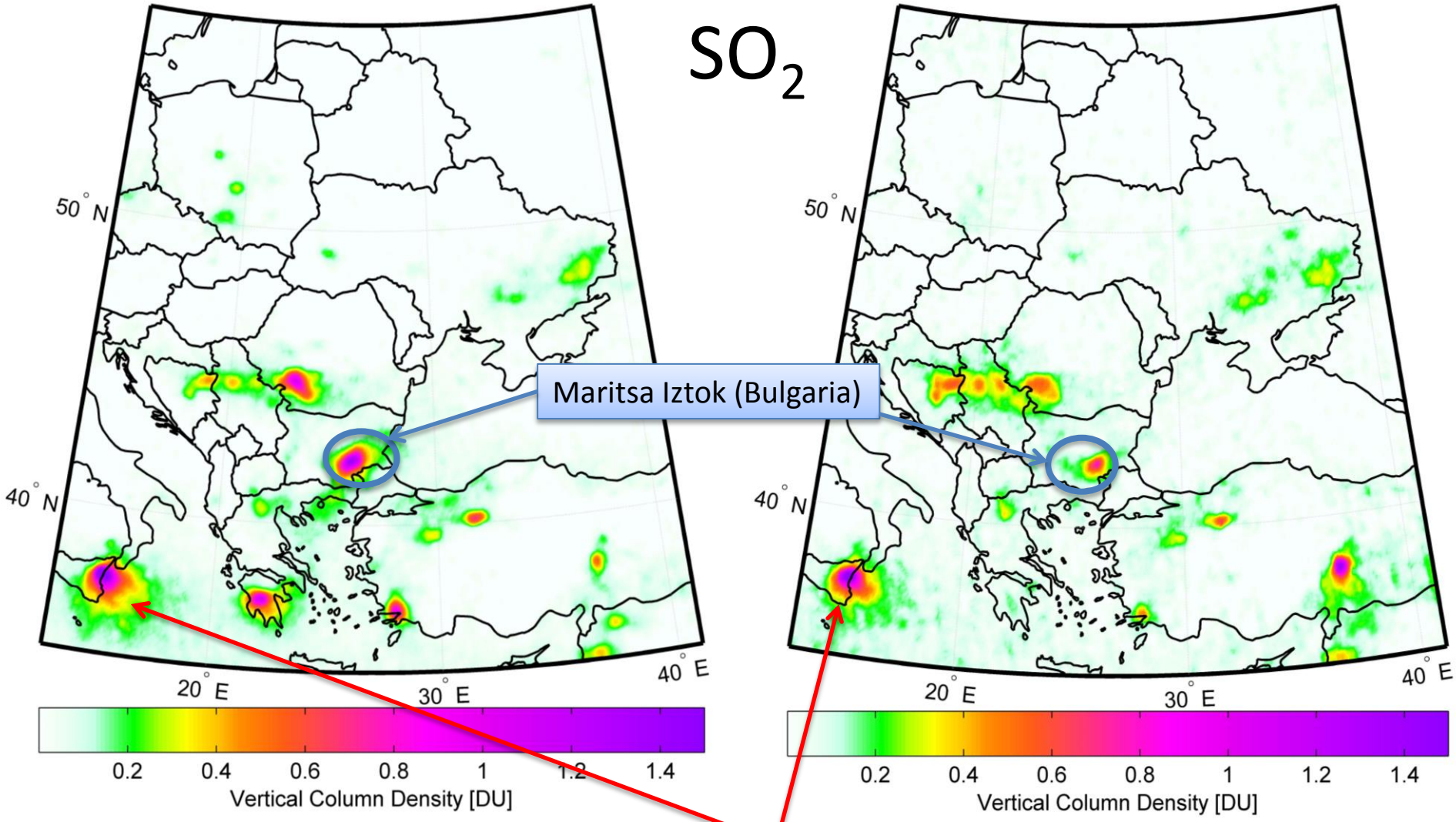


Eastern Europe

2005-2007

2011- 2013

SO_2

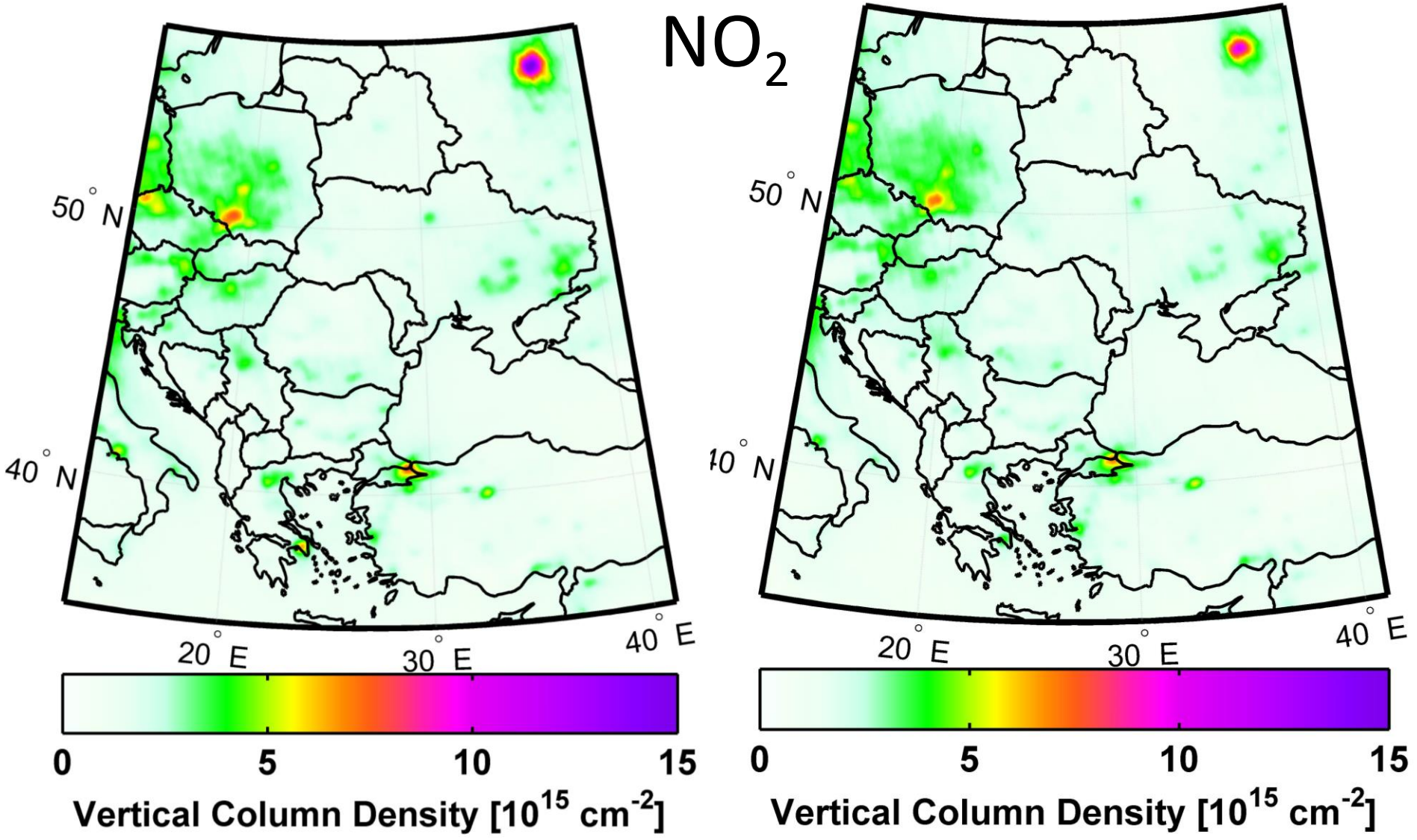


Eastern Europe

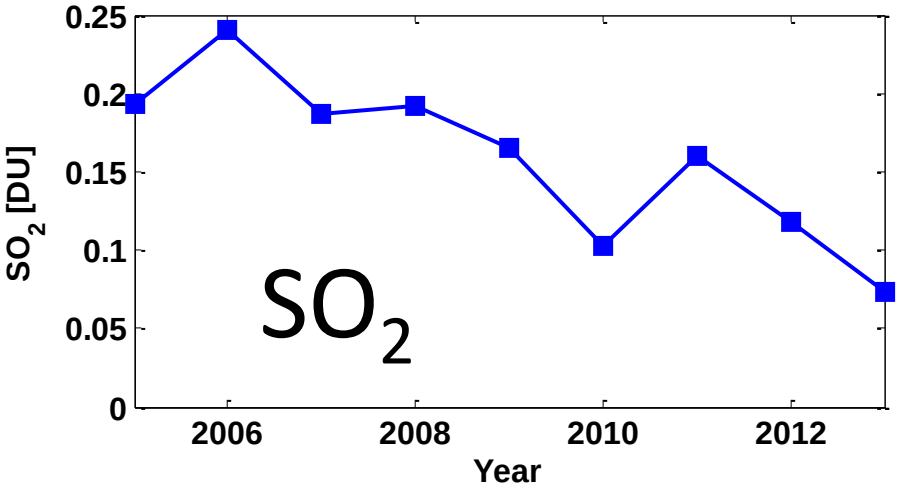
2005-2007

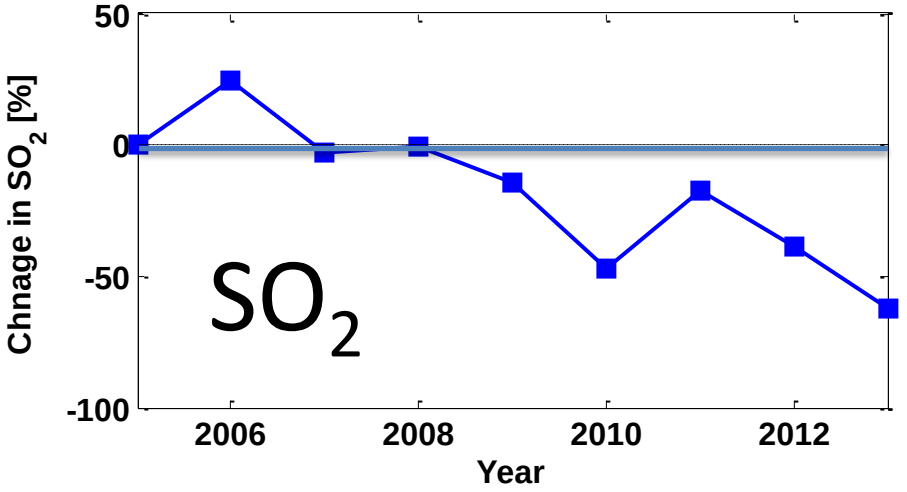
2011- 2013

NO_2

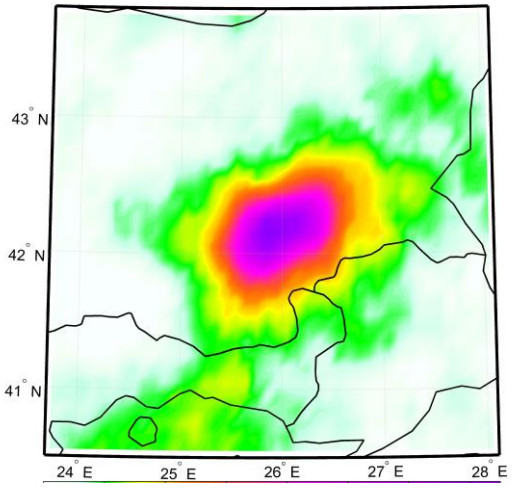


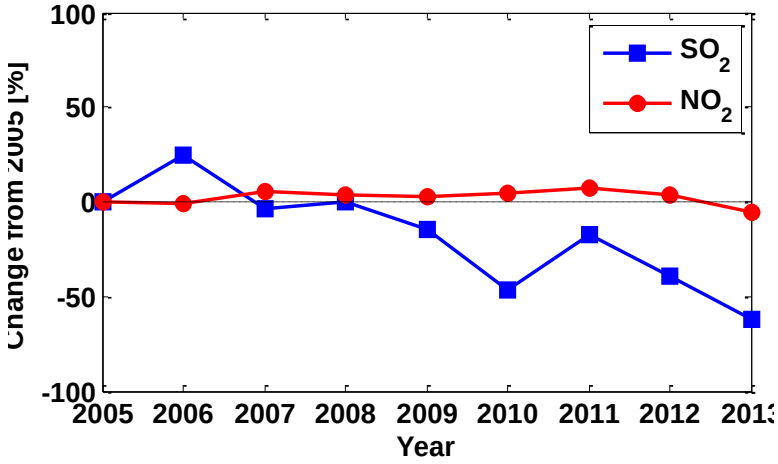
Eastern Europe: Time series for Maritsa Iztok



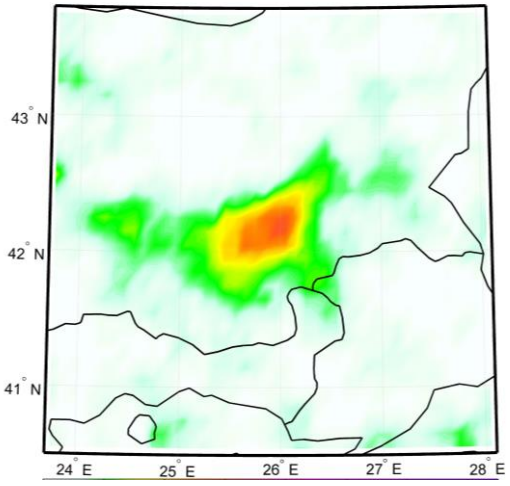


2005





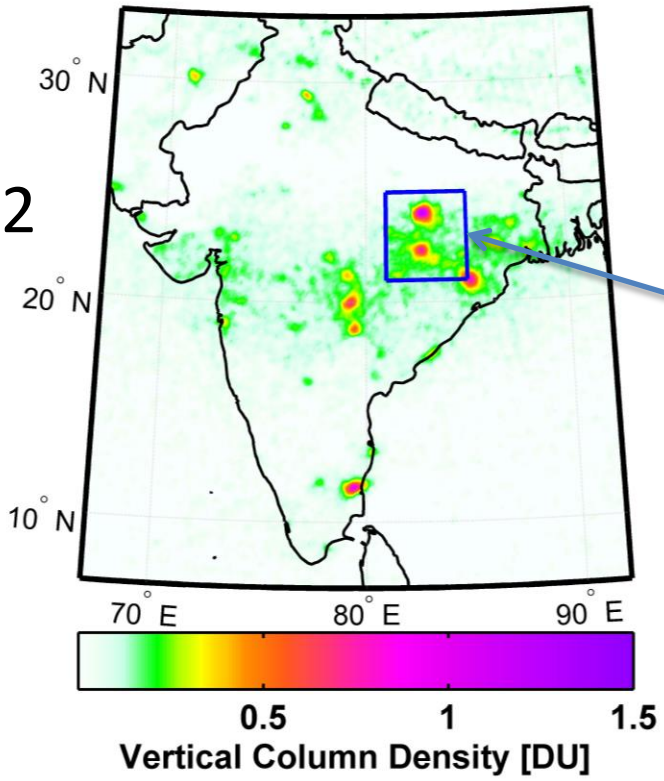
2013



India

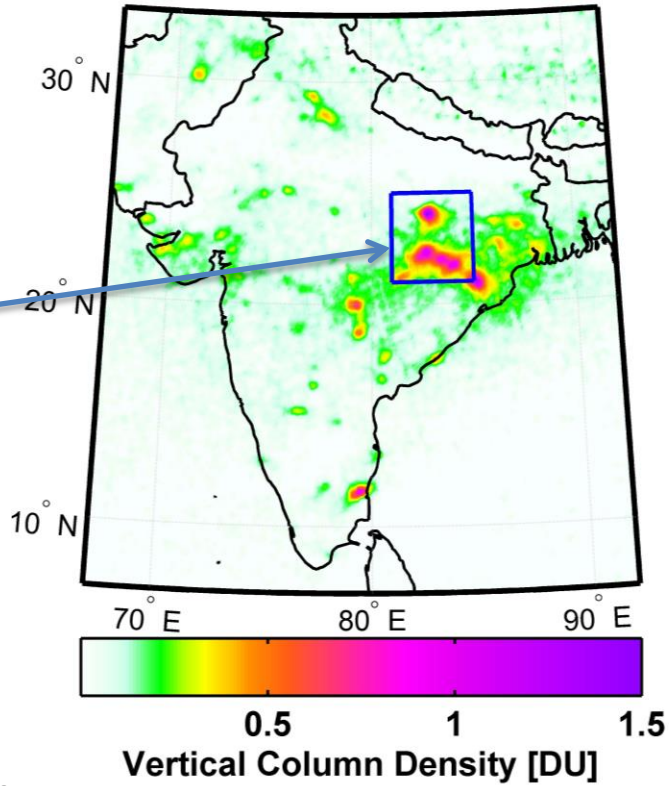
SO_2

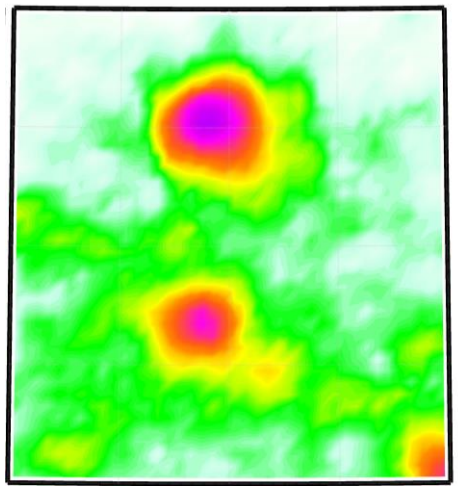
2005-2007



Power plants / smelter

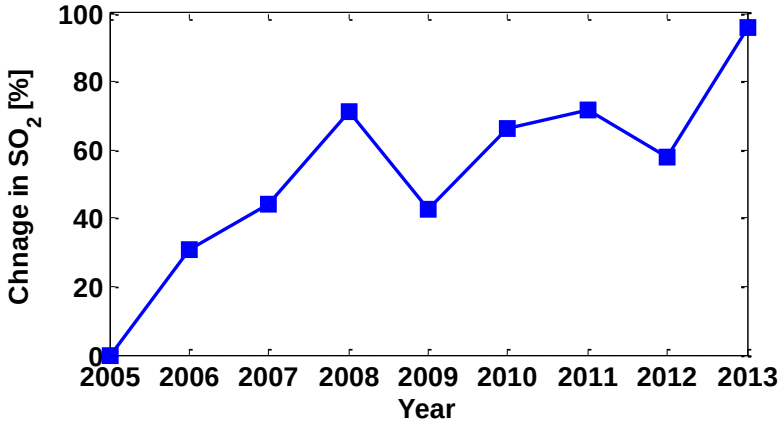
2011- 2013

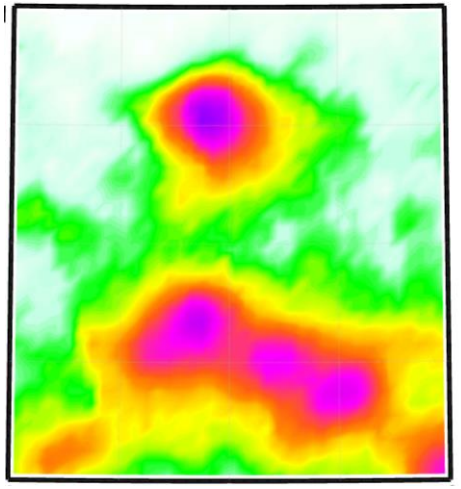




Chhattisgarh

Pronunciation: chuht-tihs-guhr



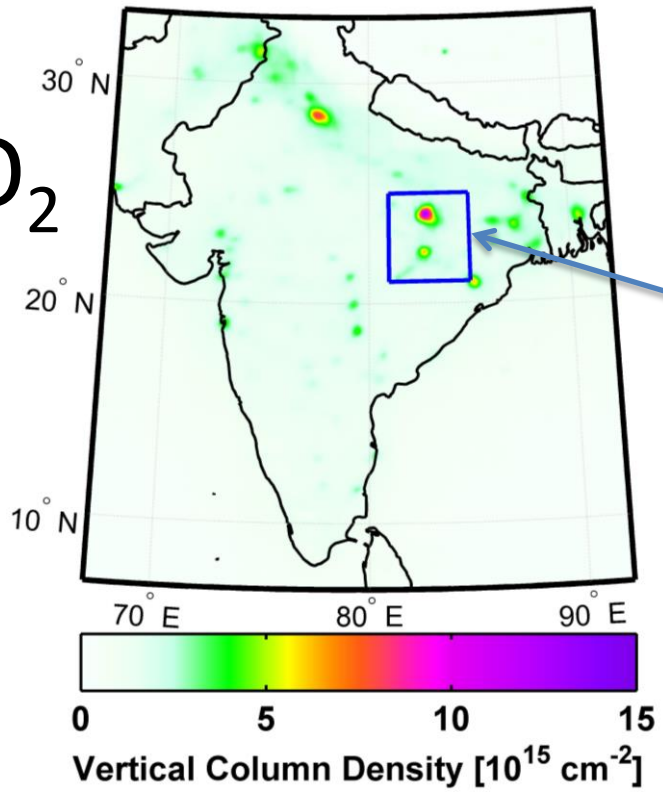


India

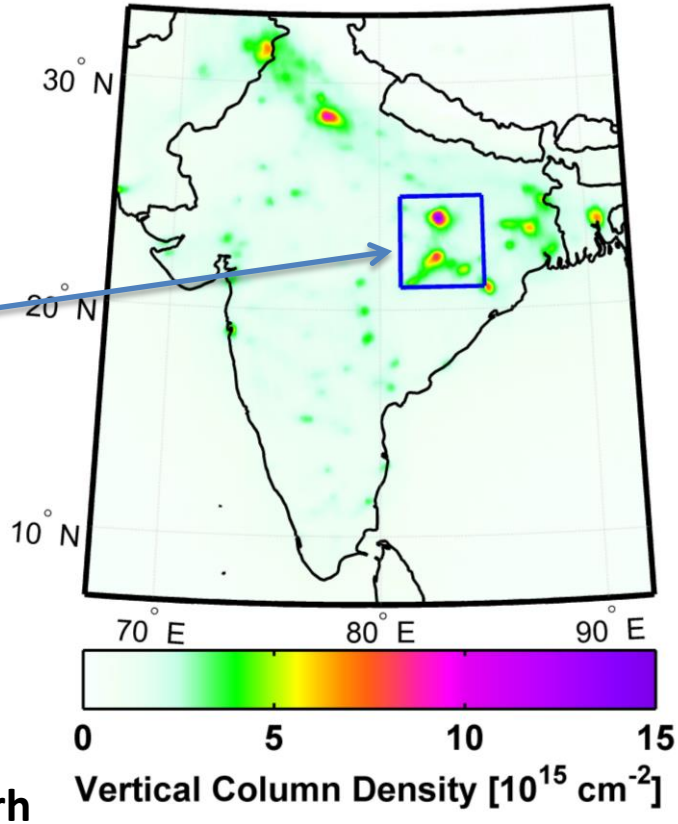
2005-2007

2011- 2013

NO_2

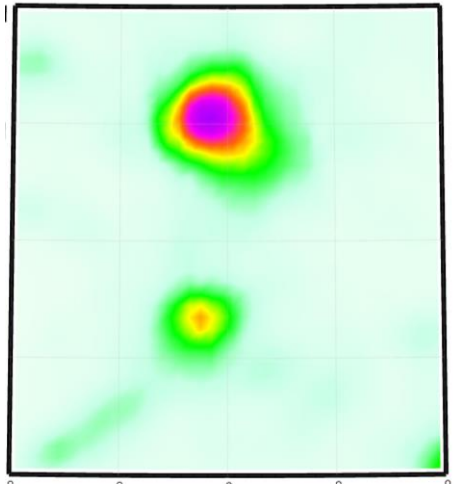


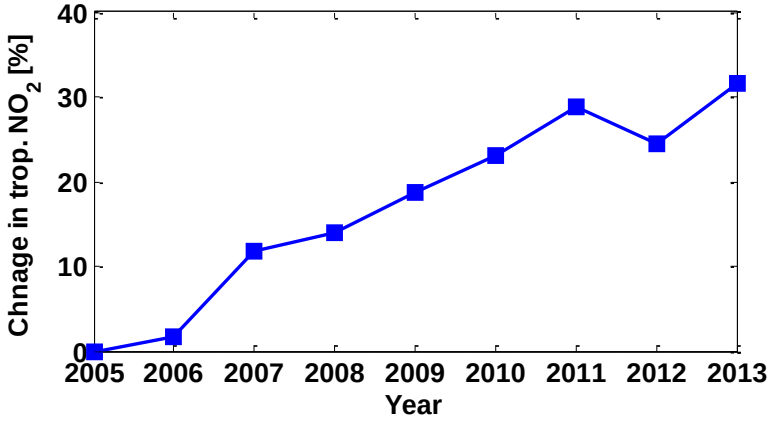
Power plants / smelter

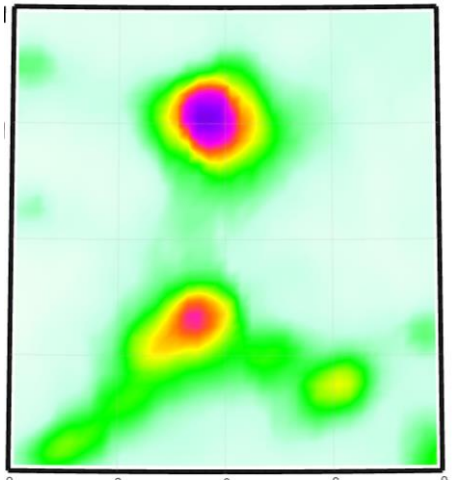


Chhattisgarh

Pronunciation: chuht-tihs-guhr

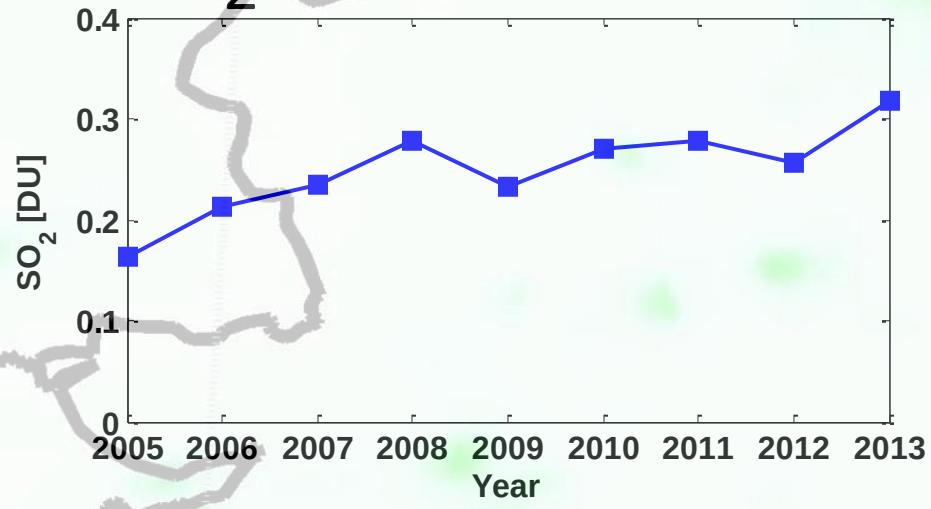


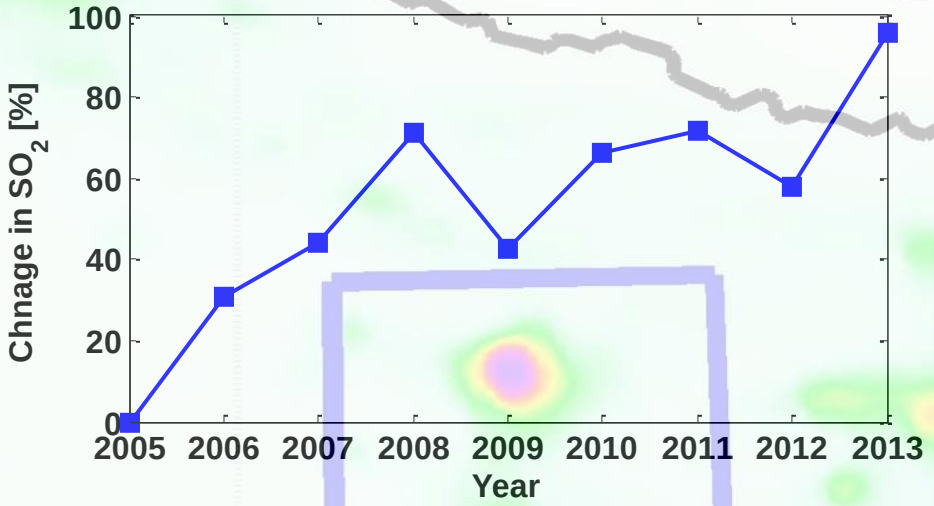




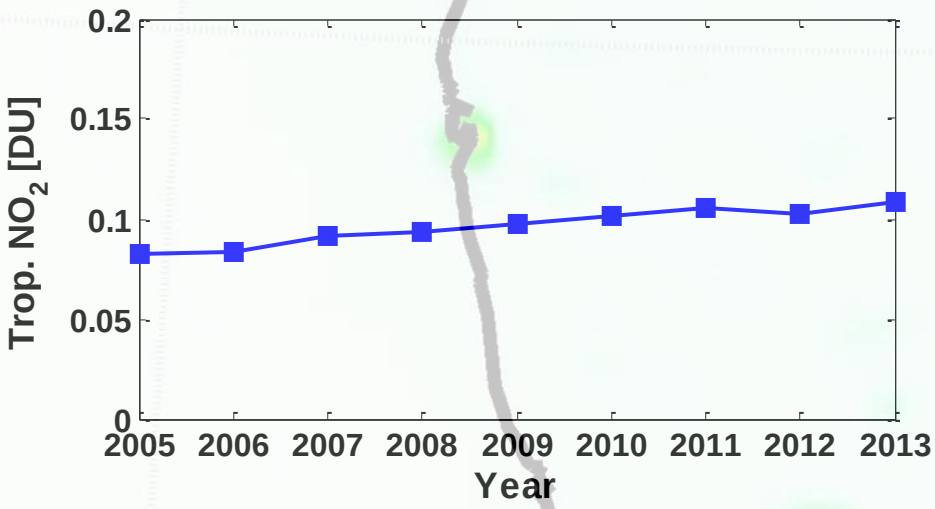
Time series: India (Chhattisgarh)

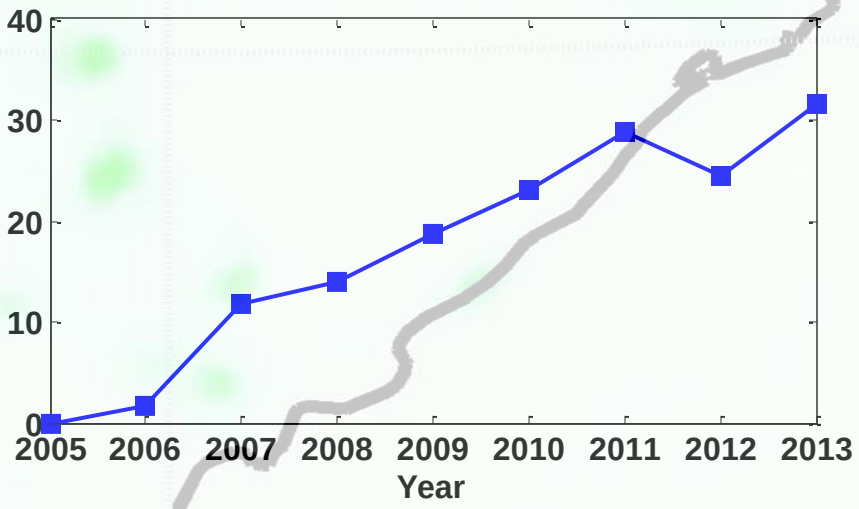
SO_2





NO_2



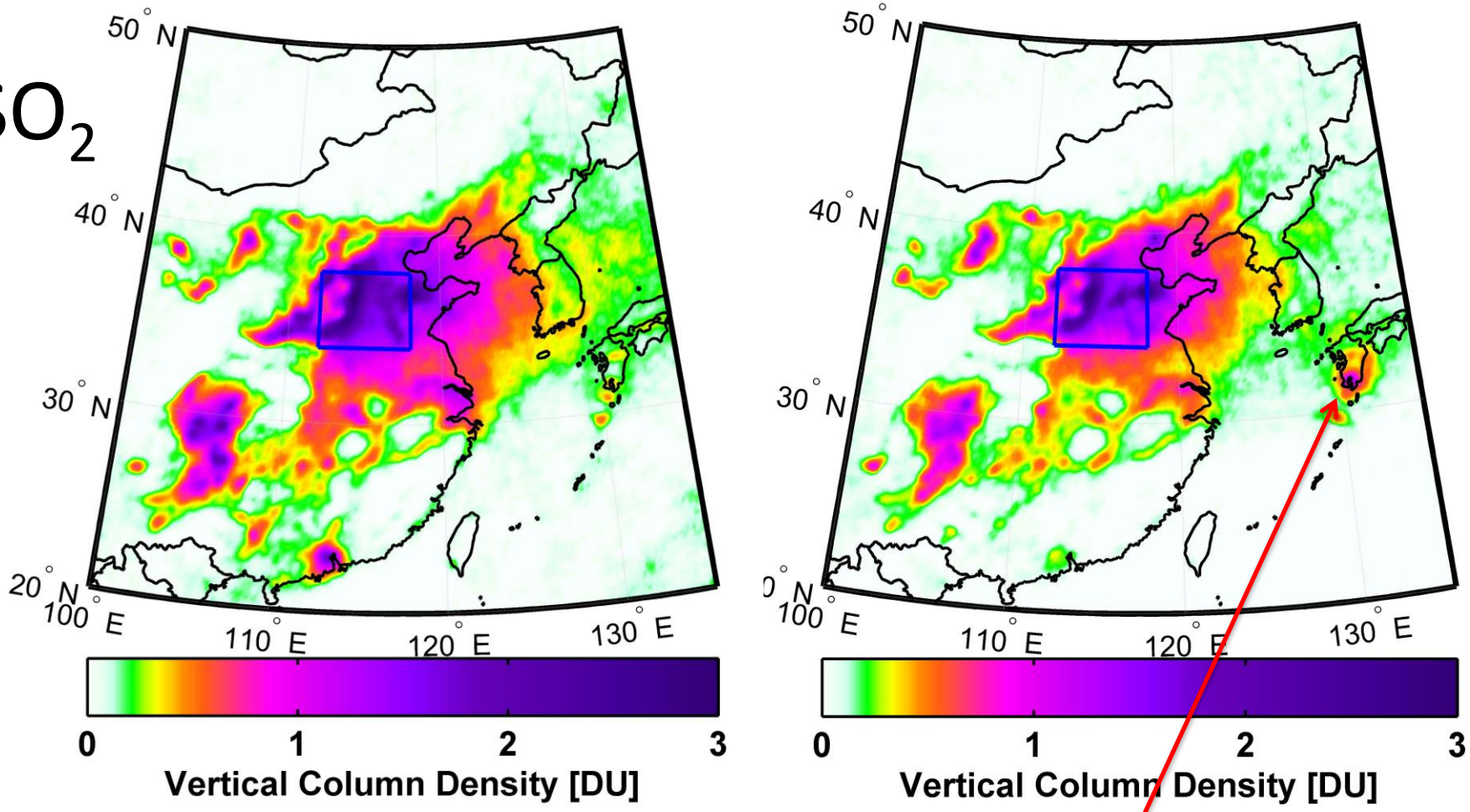


Eastern Asia

2005-2007

2011-2013

SO_2



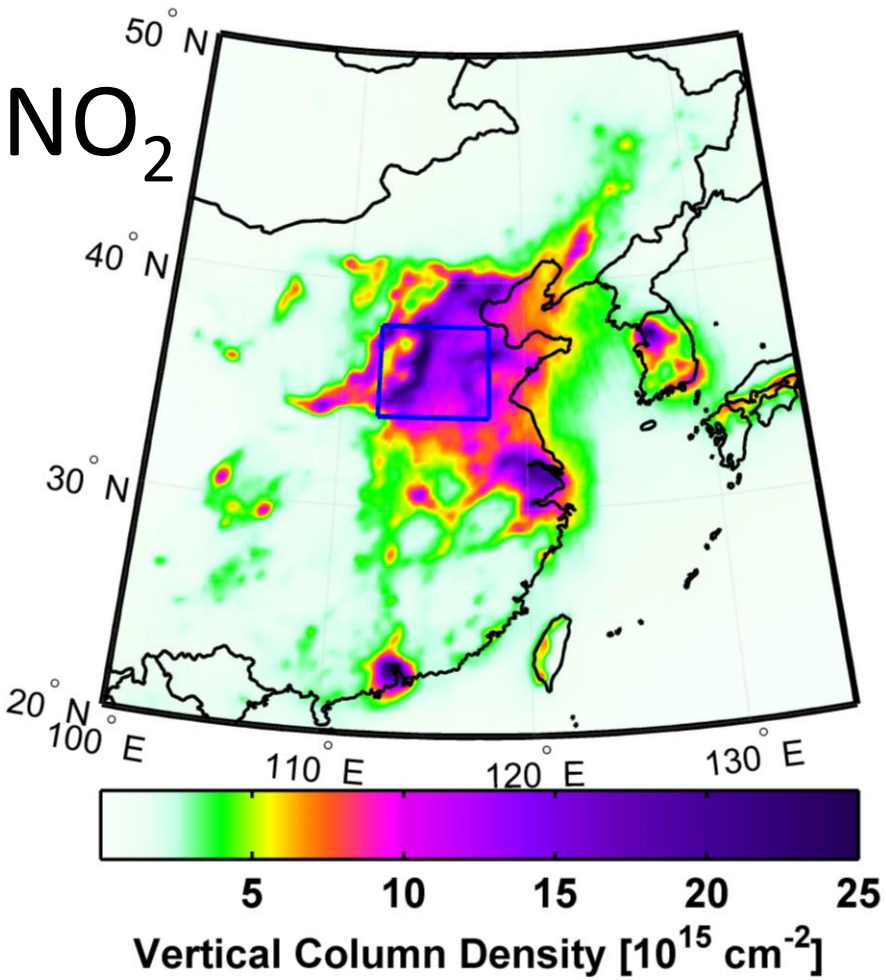
Volcano

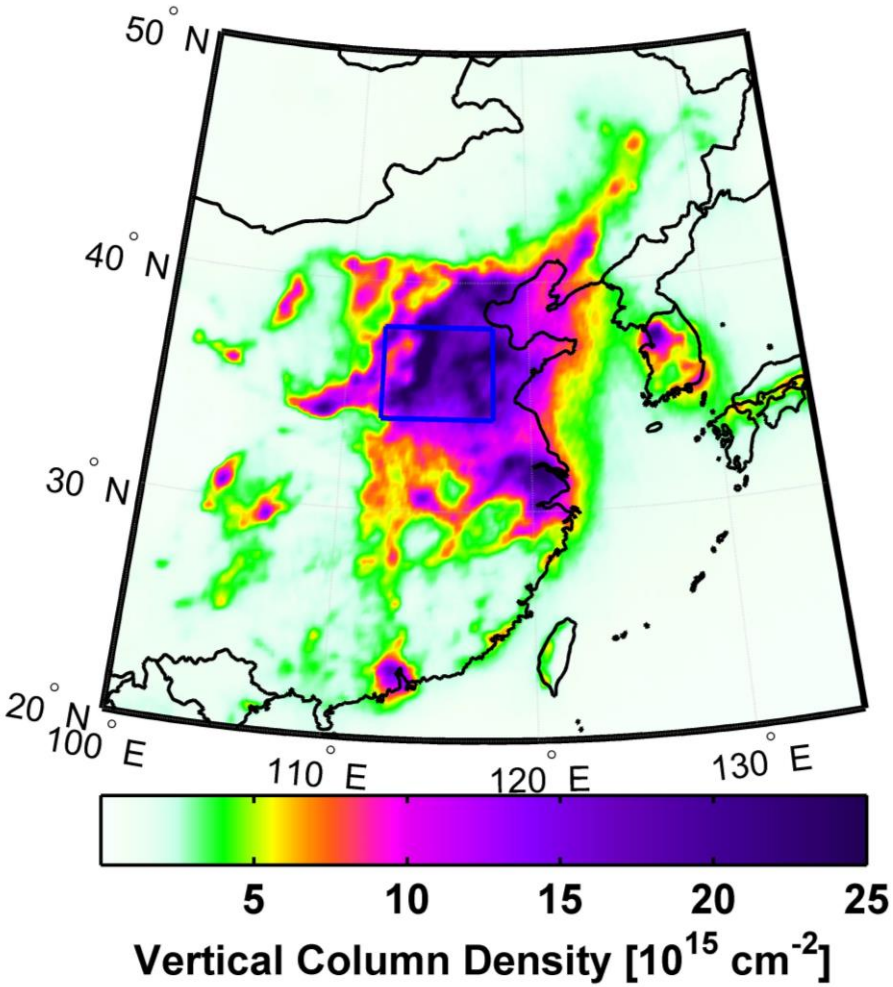
Eastern Asia

2005-2007

2011- 2013

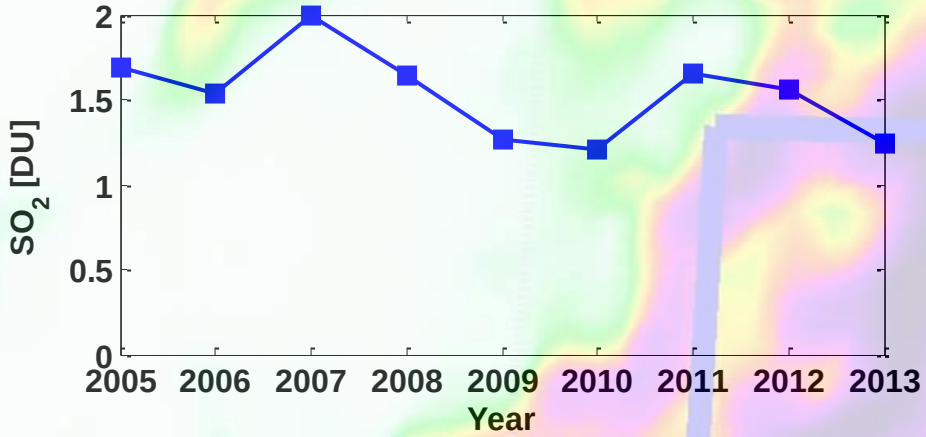
NO_2

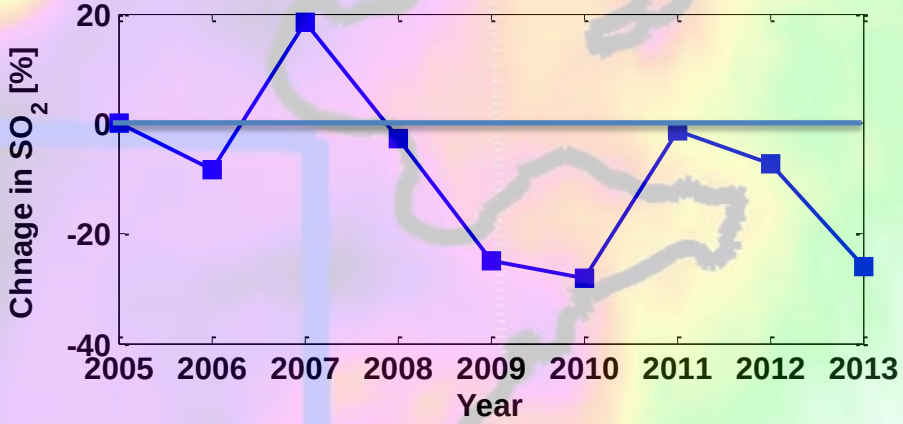




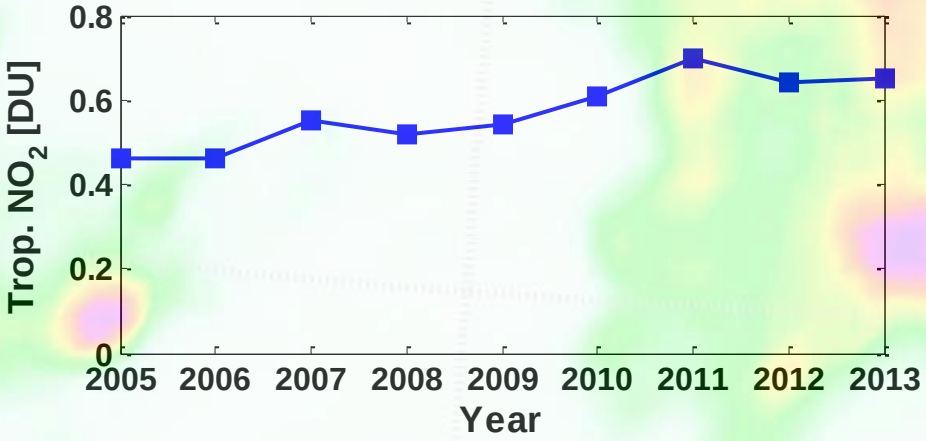
Eastern China: Time series

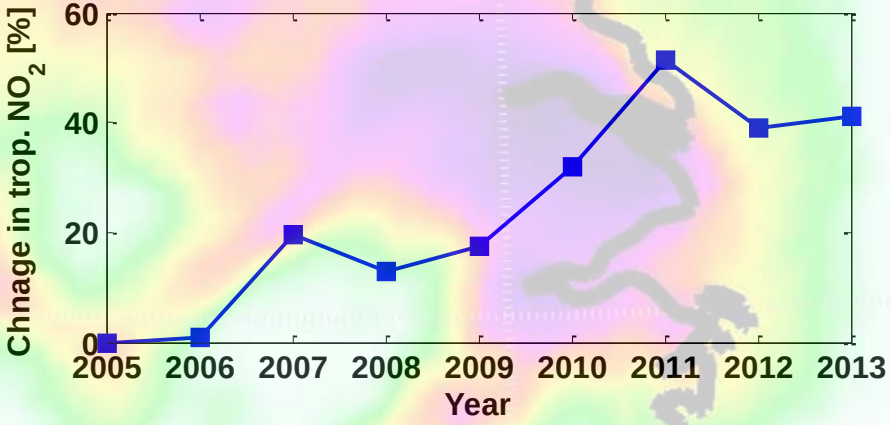
SO_2



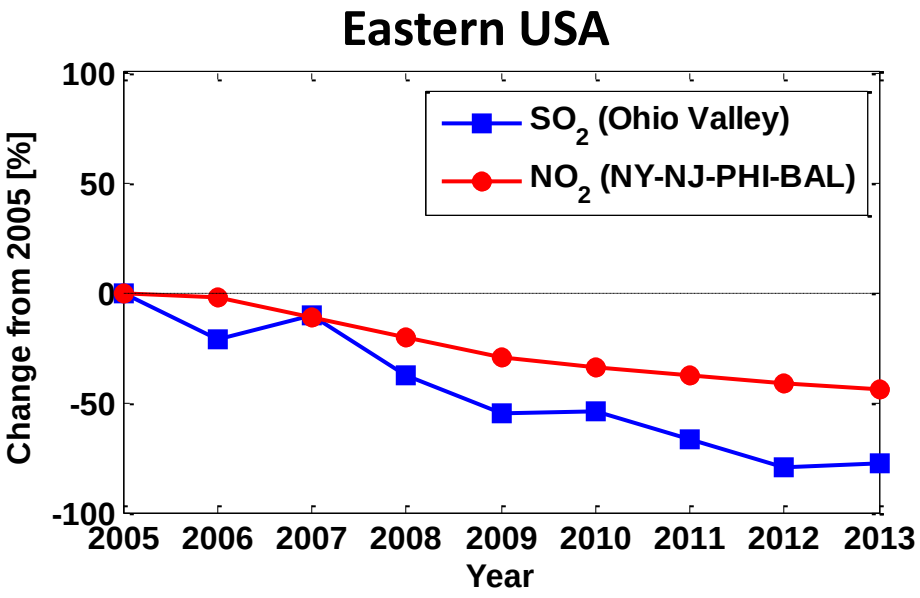


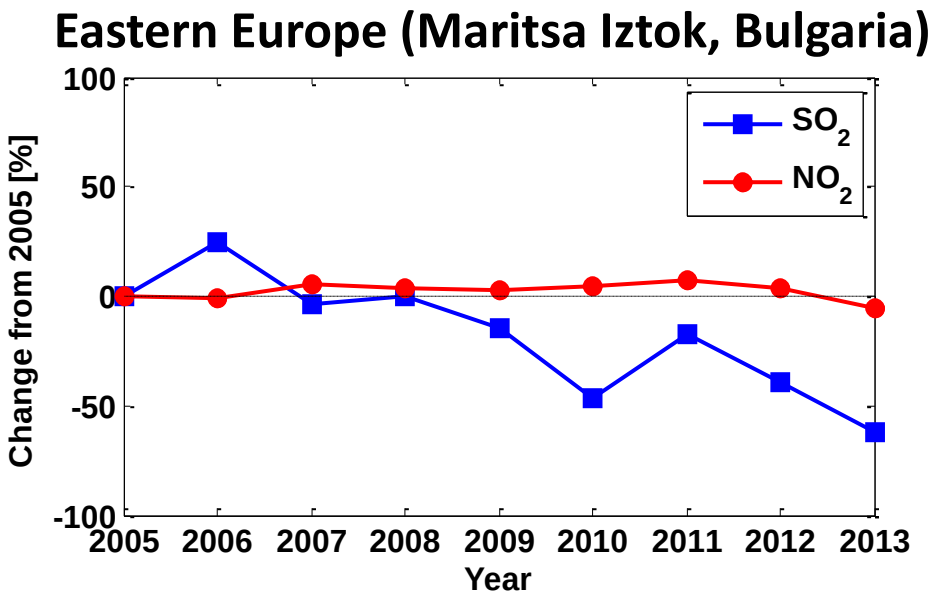
NO_2

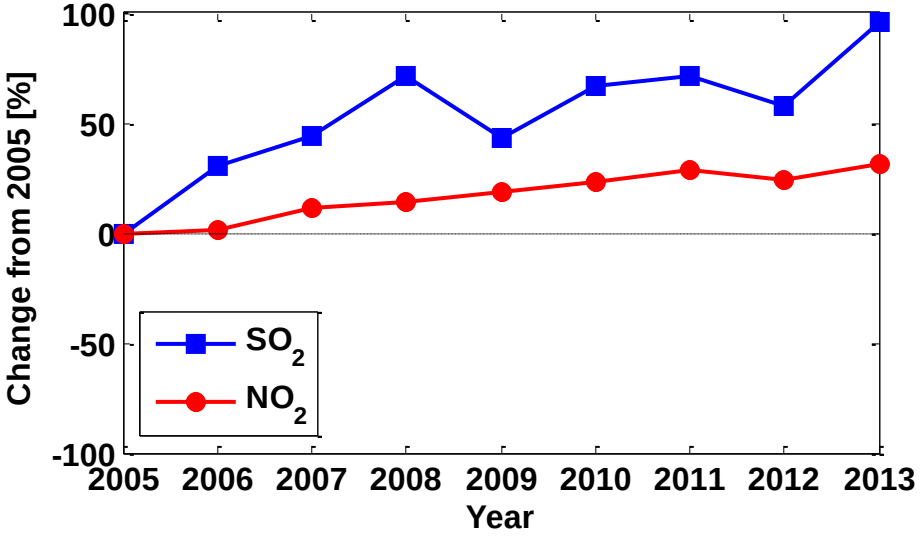


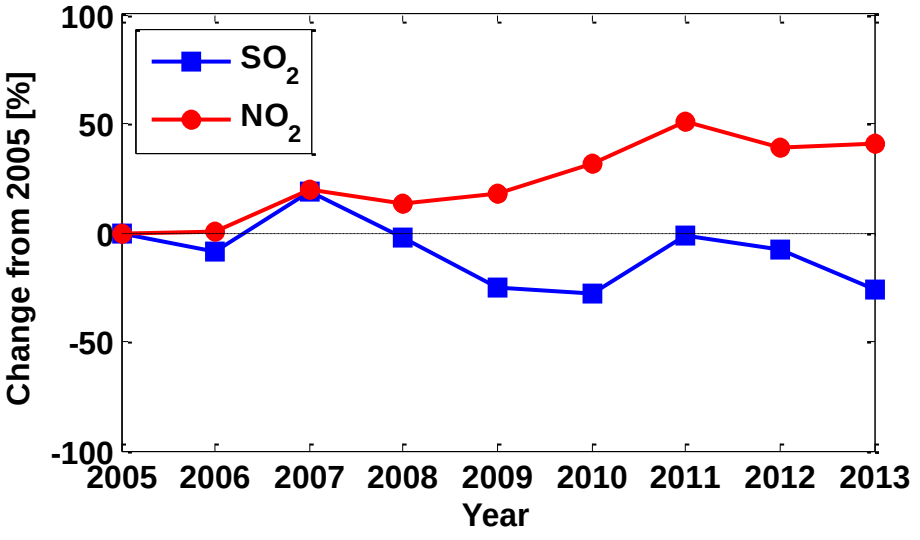


Summary


Eastern USA
SO2 (Ohio Valley)
NO2 (NY-NJ-PHI-BAL)
Change from 2005 [%]
Year
100
50
0
-50
-100
2005 2006 2007 2008 2009 2010 2011 2012 2013


Eastern Europe (Maritsa Iztok, Bulgaria)
SO2
NO2
Change from 2005 [%]
Year
100
50
0
-50
-100
2005 2006 2007 2008 2009 2010 2011 2012 2013


India (Chhattisgarh)
SO2
NO2
Change from 2005 [%]
Year
100
50
0
-50
-100
2005 2006 2007 2008 2009 2010 2011 2012 2013


Eastern Asia (Eastern China)
SO2
NO2
Change from 2005 [%]
Year
100
50
0
-50
-100
2005 2006 2007 2008 2009 2010 2011 2012 2013